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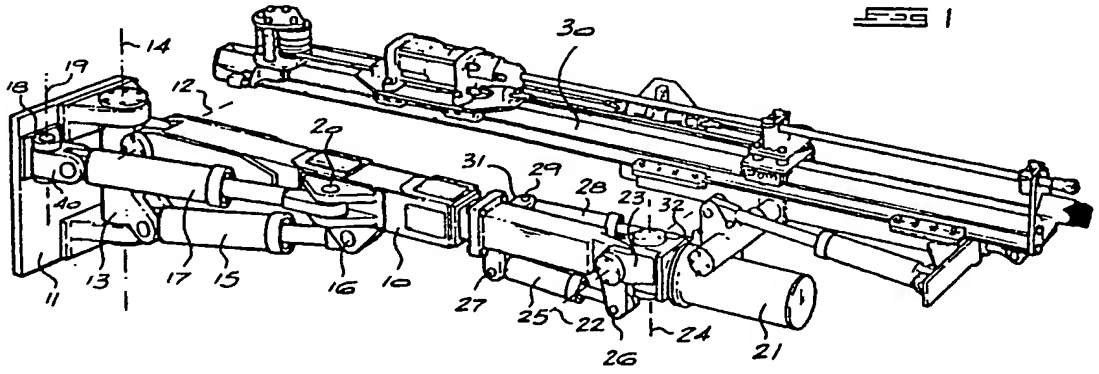
(54) Drilling boom

(57) A drilling boom 10 is pivoted about a first axis 12 or 14 on a base and is pivoted about that axis by a first hydraulic cylinder 15 or 17. It carries a feeder beam carrier 21 at its forward end. The carrier 21 is pivoted at the forward end of the boom 10 about a second axis 22 or 24 which is parallel to the first axis 12 or 14, and it is moved about the second axis 22 or 24 by a second hydraulic cylinder 25 or 28 in a sense opposite to that in which the boom 10 is moved by the first cylinder 15 or 17. The first and second cylinders are so dimensioned and hydraulically interconnected that fluid which is expelled from the first cylinder 15 or 17 actuates the second cylinder 25 or 28 and vice versa. The angular movements of the boom 10 and carrier 21 are equal in magnitude.



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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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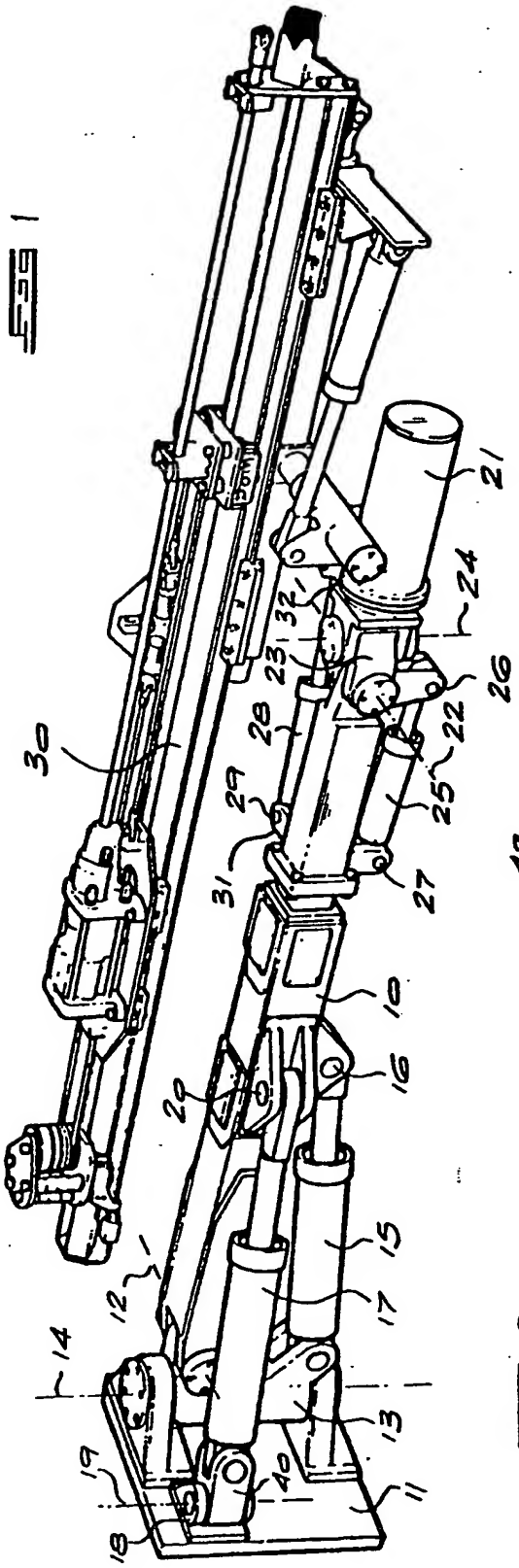

Fig 1

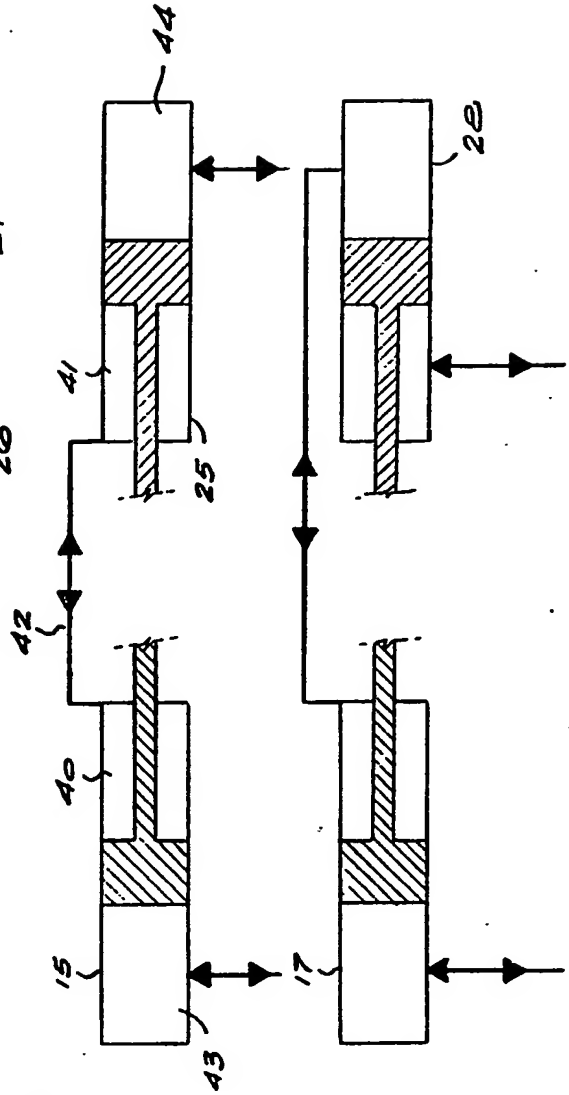

Fig 2

Fig 3

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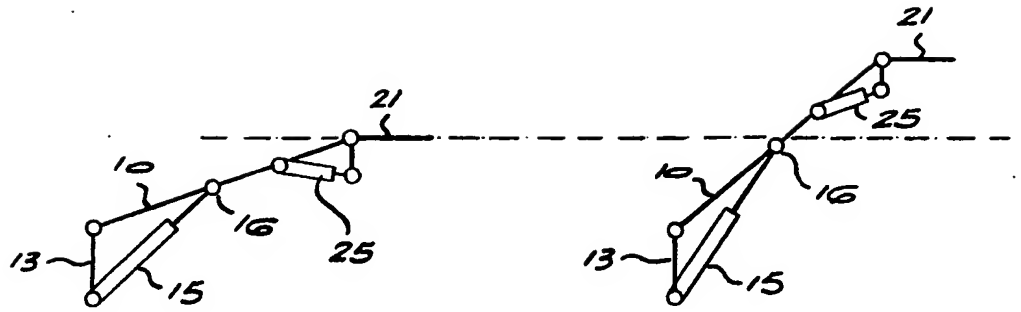

Fig 4

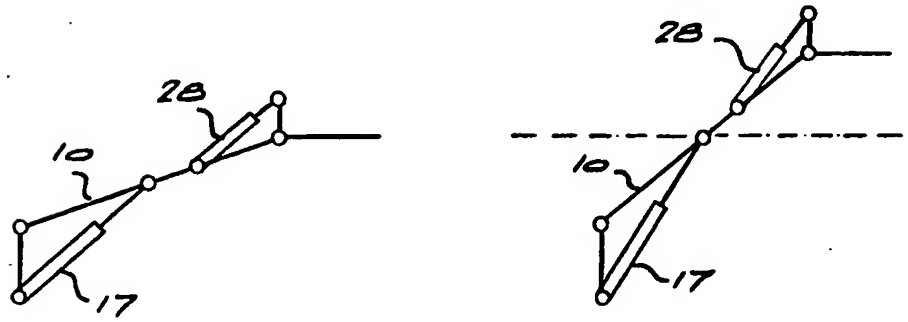

Fig 5

SPECIFICATION

Drilling boom

BACKGROUND TO THE INVENTION

This invention relates to a drilling boom of the kind in which a drill feeder beam is carried at the forward end of an extensible boom which at its rearward end is pivoted to a base to lift and slew.

Unless the feeder beam is properly tilted and its orientation readjusted when the boom tilts and slews, the beam does not remain parallel to the centre line of a tunnel and retain the same drilling orientation in all positions to which the boom is adjusted. This may lead to less than optimum blasting results.

It is an object of the invention to provide a boom which has an automatic interface between lifting of the boom and tilting of the beam as well as slewing of the boom and orientation of the beam.

Furthermore booms used currently result in a face coverage pattern exhibiting curvature of one form or another e.g. "hour glass" curvature. It is another object of the invention to overcome this drawback.

SUMMARY OF THE INVENTION

According to the invention a drilling boom is pivoted about a first axis on a base, the boom is moved about the first axis by means of a first hydraulic cylinder, the boom carries a feeder beam carrier at its forward end, the carrier is pivoted at that end about a second axis parallel to the first axis, the carrier is moved about the second axis by means of a second hydraulic cylinder in a sense opposite to the sense in which the boom is moved by the first cylinder and the first and second cylinders are so dimensioned and so hydraulically interconnected that fluid expelled from the first cylinder actuates the second cylinder and the other way round.

In the preferred form of the invention the first and second cylinders are in communication such that the angular movements of the boom and carrier are equal.

Further according to the invention the boom is also pivoted about a third axis at right angles to, and in a parallel plane to the plane containing, the first axis, a third hydraulic cylinder causes the boom to move about the third axis, the carrier is pivoted to the boom end about a fourth axis at right angles to the second axis, a fourth hydraulic cylinder causes the carrier to move about the fourth axis, and the third and fourth cylinders are so dimensioned and so hydraulically interconnected that fluid expelled from the third cylinder actuates the fourth cylinder and the other way round.

In the case of the third and fourth cylinders the full bore and annular chambers are preferably interconnected.

DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of one embodiment of the invention,

Figure 2 is a diagrammatic representation of two hydraulic cylinders,

Figure 3 is a view similar to Fig. 3 of another pair of cylinders,

Figure 4 is a diagram illustrating the lift and tilt principles of the invention, and

Figure 5 is a diagram of the slew and orientation principles.

DESCRIPTION OF EMBODIMENTS

In Fig. 1 a boom 10 is carried on a base plate 11 secured to a suitable conveyance. The boom 10 is extensible in a manner known per se. It is pivoted about a lifting axis 12 on a bracket 13. The bracket 13 is pivoted about an axis 14 parallel to the plate 11.

Pivoted to the bracket 13 is a lift cylinder 15 extending to a pivot 16 on the boom 10. By expanding and contracting the cylinder 15 the boom 10 is caused to move in a plane containing the longitudinal axis of the boom 10, the axis of the cylinder 15 and the axis 14. This will usually be a vertical plane so that the boom is lifted and lowered by the cylinder 15.

A slew cylinder 17 is pivoted through a link 40 on a bracket 18 on the plate 11 about an axis 19 parallel to the axis 14 and about a pivot 20 on the boom 10. Expansion and contraction of the cylinder 17 causes the plane in which the boom moves under the action of the cylinder 15 to pivot about the axis 14 which will usually be vertical.

A feeder beam 30 is rotatably bracketed to a carrier 21 in a well known manner. The carrier 21 is pivoted about an axis 22 on a bracket 23 which in turn is pivoted about an axis 24 on the forward end of the boom 10. A cylinder 25 is pivoted about a pivot 26 on the bracket 23 and about a pivot 27 on the boom 10. The cylinder 25 is the tilt cylinder and by expanding and contracting it the tilt of the beam 30 relatively to the boom 10 may be altered.

Orientation cylinder 28 is pivoted at a pivot 29 on a bracket 31 fast with the boom 10 and on a pivot 32 on the forward end of the boom 10. With the longitudinal axes of the boom 10 and the carrier 21 in the same plane expansion and contraction of the cylinder 28 causes the orientation of the beam 30 to change in a plane normal to the last mentioned plane.

The various pivot lines and axes are so chosen and positioned and the cylinders 15, 17, 25 and 28 so chosen that the following conditions can be satisfied for all angular positions of the boom 10:—

1.

Angular movement of the boom 10 about the axis 12 is equal and opposite to the angular

movement of the carrier 21 about the axis 22.

2.

Angular movement of the boom 10 about the axis 14 is equal and opposite to the angular movement of the carrier 21 about the axis 24.

This is illustrated diagrammatically in Figs. 4 and 5. In Fig. 4 two positions of the lift cylinder 15 are illustrated, while in Fig. 5 two positions of the slow cylinder 17 are illustrated.

The manner of interconnection of the cylinders 15 and 25 is illustrated in Fig. 2. When the cylinder 15 expands it pumps fluid from its annular section 40 into the annular section 41 of the cylinder 25 along the connection 42. For contraction fluid is fed into the full bone section 44 of the cylinder 25 thereby pumping fluid from the annular section 41 back into the annular section 40 of the cylinder 15.

On the other hand the cylinders 17 and 28 have to interact in a different way. In this case the cylinders expand and contract simultaneously. Such an action could be achieved by means of the structure illustrated in Fig. 3.

During testing, the inventors compared predicted lift, slew, tilt and orientation angles with actually measured values of these angles, and found a very good correlation between the two sets of values. For instance, where a lift angle of 30° is caused by actuation of the cylinder 15, the predicted tilt angle is also 30°. A practical measurement resulted in a tilt angle with exactly this value. Where the slew angle resulting from appropriate actuation of the cylinder 17 resulted in a slew angle of 40°, the measured slew angle was 39, 15° which represents a minor deviation only from the predicted slew angle of 40°.

In addition, practical testing has shown that the upright walls of a mine tunnel formed by blasting with drilled holes made by a machine fitted with a boom of the type described exhibit very little deviation from the vertical.

CLAIMS.

1. A drilling boom which is pivoted about a first axis on a base, is moved about the first axis by means of a first hydraulic cylinder, and carries a feeder beam carrier at its forward end, with the carrier pivoted at that end about a second axis parallel to the first axis and being moved about the second axis by means of a second hydraulic cylinder in a sense opposite to the sense in which the boom is moved by the first cylinder, and the first and second cylinders being so dimensioned and so hydraulically interconnected that fluid expelled from the first cylinder actuates the second cylinder and the other way round.

2. The boom claimed in claim 1 in which the angular movements of the boom and carrier are equal.

3. The boom claimed in either one of the above claims in which the boom is also pivoted about a third axis at right angles to, and in a parallel plane to the plane containing, the first axis, a third hydraulic cylinder causes the boom to move about the third axis, the carrier is pivoted to the boom end about a fourth axis at right angles to, and in a parallel plane to the plane containing, the second axis, a fourth hydraulic cylinder causes the carrier to move about the fourth axis, and the third and fourth cylinders are so dimensioned and hydraulically interconnected that fluid expelled from the third cylinder actuates the fourth cylinder and the other way round.

4. A drilling boom substantially as herein described with reference to the accompanying drawings.

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